



# Naval Ship Design

March 31, 2009

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Chief Engineer

Naval Sea Systems Command

(SEA 05)



# SECNAV – Sea Air Space

## April 3, 2007

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There are two basic reasons why shipbuilding commands so much of our attention.

First, our Navy and Marine Corps necessarily revolves around our fleet—300 or so capital assets that define the global reach and awesome striking power that define the United States Navy-Marine Corps team.

Second, our current shipbuilding program is simply not meeting our expectations.

We must do better. The need to do better is especially urgent, for today's security environment requires that we modernize and re-capitalize the fleet across the full range of our capabilities.

- First, the Navy must re-assert its control over the entire shipbuilding acquisition process. The Navy owns the fleet, and the Navy is the customer.
- Second step - the Navy must define the design constraints to optimize the overall capability of the Fleet. The lead systems integrator should be the Navy—not the contractor.
- Third step - contractors must design for production and sustainment. Every time the Navy decides to build a new platform, it should be viewed as an opportunity to re-evaluate our production processes.
- Four, the Navy needs to use independent cost estimates for the trade-offs and decisions that we make
- Five, detail design and construction contracts must be supported by mature specifications.
- Finally, the Navy needs to provide knowledgeable program oversight.

## **Imperative for Action!**

- Restore Ship Design Capability
- Design the Fleet
- Consider production, maintenance, and modernization in Design
- Improve Cost Estimating Capability
- Improve Ship Specification process
- Improve Government Workforce
  - Capability
  - Capacity

**Your Participation in this Workshop is Important to  
Keeping the Navy capable and relevant**

- **Navy Personnel**
  - **Active Duty:** 332,039 (51,165 Officers; 276,475 Enlisted)
  - **Midshipmen:** 4,399
  - **Ready Reserve:** 119,735 [As of February]
    - **Reserves currently mobilized:** 6,547
  - **Personnel on deployment:** 64,177
  - **Navy Department Civilian Employees:** 185,658
- **284 Ships and Submarines**
  - **Ships Underway (away from homeport):** 110 (39% of total)
    - **On deployment:** 105 ships (37% of total)
  - **Subs underway (away from homeport):** 29 (53% of Sub Force)
    - **On deployment:** 20 (37% of sub force)
- **3700+ Aircraft**



## **Core Capabilities**

- Forward Presence
- Deterrence
- Sea Control
- Power Projection
- Maritime Security
- Humanitarian Assistance and Disaster Response



# NAVSEA Priorities



VADM McCoy  
COMNAVSEA

- ***Sustain Today's Fleet Efficiently and Effectively***
- ***Build an Affordable Future Fleet***
- ***Enable our People***





# The Navy Today (and goal for future)

	<b>Ship Battle Forces</b>	<b>Active In Commission</b>	<b>313 Ship Navy</b>
Totals	284	249	313
Aircraft Carriers	11	11	11
Ballistic Missile Submarines	14	14	14
Guided Missile Submarines	4	4	4
Surface Combatants	99	97	143
Nuclear Attack Submarines	53	53	48
Amphibious Warfare Ships	33	33	31
Combat Logistics Ships	32	0	30
Support/Mine Warfare Ships	29	27	32
Active Reserves	9	9	
Other		1	

# Thirty Year Shipbuilding Plan

Type/Class	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	Total
<b>CVN 21</b>				1				1				1				1					1				1					1	7
<b>Surface Combatants</b>	1	1	2	1	2	1	2	2	2	2	2	2	2	2	1	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	69
DDG 1000	1	1	1	1	1																										5
CG(X)			1		1	1	2	2	2	2	2	2	2	2																	19
DDG(X)															1	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	45
<b>LCS</b>	2	3	3	4	6	6	6	6	6	6	6	4													1		2	5	5	5	81
<b>SSN 774</b>	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1	2	1	2	1	2	1	2	1	2	1	53
<b>SSBN(X)</b>												1		1	1	1	1	1	1	1	1	1	1	1	1						12
<b>Amphibious Warfare Ships</b>									1	1	1	2		1	1	1		2		1	1	1		2		1	1	1		2	20
LHD(X)													1			1		1					1				1			1	8
LSD(X)									1		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	12
<b>Combat Logistics</b>	1												1	2	2	2	2	2	2						1		1	1	1		20
<b>MPF (Future)</b>	1	2		2	1	2	1																								9
MPF T-AKE	1																														1
MPF LHA			1																												2
MPF LMSR					1																										3
MPF MLP			1		1	1																									3
<b>SUPPORT Vessels</b>	1	1	1	2	1	2	2		1	1	1	2		2	3	2	2				1	1	1	1	1	1	1				31
LCC(R)																															2
JHSV		1	1	1	1	1	1	1																							7
T-ATF																															
Other																															18
<b>New Const</b>	7	8	8	12	12	13	13	12	12	13	12	14	7	10	9	10	11	10	6	7	9	8	7	11	7	10	11	11	9	13	302

## NOTE

Each ship class has an Analysis of Alternatives that derives the requirements for that class. This AOA may be five years before the lead ship contract award. The PDR/CDR is generally 3/2 years prior to contracting the ship. Acquisition decisions must be made prior to these milestones.

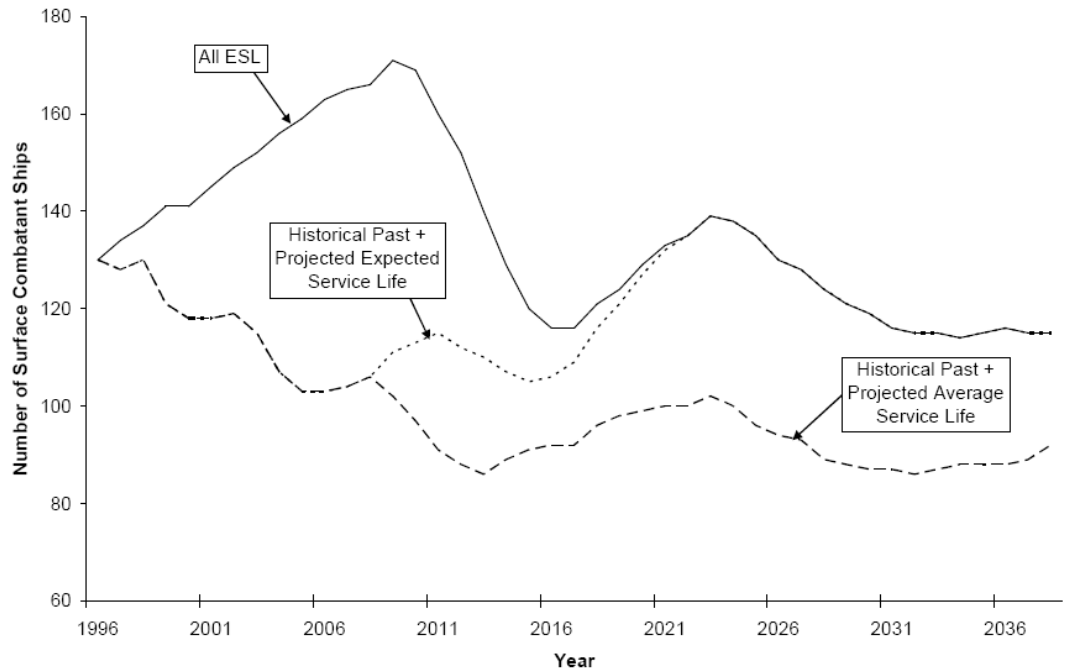
Information Based on Report to Congress on Annual Long-Ragne Plan for Construction of Naval Vessels for FY 2009

- Low integration risk if Technology achieves TRL 7 in this year
- Moderate to High Integration Risk if Technology achieves TRL 7 in this year
- Achieving TRL 7 in these years is only appropriate for Component Upgrades



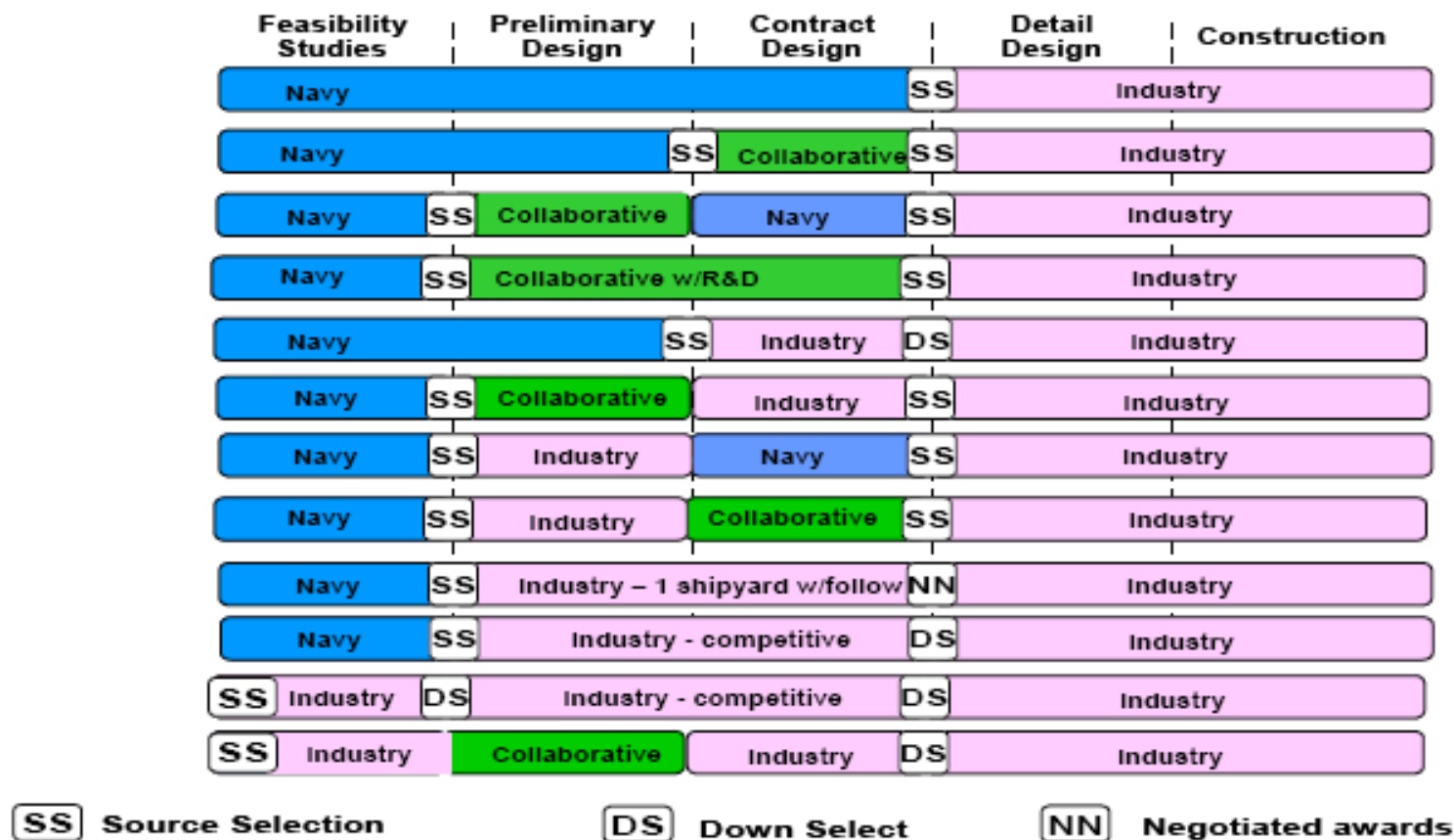
# Need to Design Our Ships to reach their Expected Service Life

- Surface Combatants have typically been retired before their Expected Service Life
  - The cost of modernization is often cited as a reason
- The 313 ship Navy includes 143 Surface Combatants
- We will never achieve 143 Surface Combatant if our ships do not reach the end of their Expected Service Life



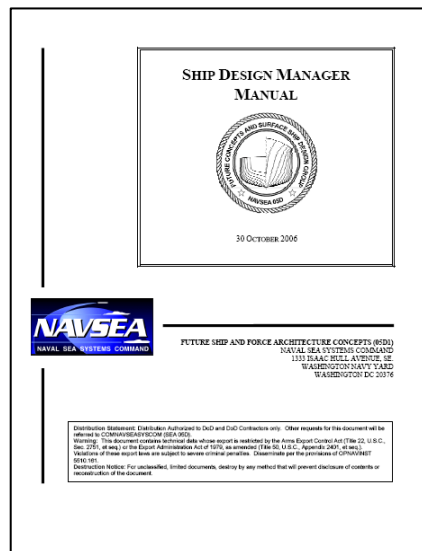
Koenig, Dr. Philip, Don Nalchajian, and John Hootman,  
 "Ship Service Life and Naval Force Structure,"  
 ASNE ETS 2008, 23-25 Sept 2008

# Who does the work?



SEA 05 **must** have the capability to implement design in all of these acquisition strategies

# Foundation Documents for an Effective and Affordable Design Process



# Ship Design and Analysis Tool Goals

- “Accomplishing these ambitious goals will be a challenge, but is essential for crafting affordable, executable ship programs in an increasingly complex national security environment”
  - Still true over a year later
- Requires teaming across Government, Academia, and Industry



DEPARTMENT OF THE NAVY  
NAVAL SEA SYSTEMS COMMAND  
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WASHINGTON NAVY YARD DC 20376-0001

IN REPLY TO

9000  
Ser 05D/04  
4 FEB 2008

From: Commander, Naval Sea Systems Command

Subj: SHIP DESIGN AND ANALYSIS TOOL GOALS

1. This memorandum establishes high-level capability goals for NAVSEA design synthesis and analysis tools in order to guide development efforts within the Navy and for the DoD sponsored CREATE (Computational Research and Engineering Acquisition Tools and Environments) program. Specific initiatives should be evaluated on the basis of how they contribute to achieving these goals. The targeted capabilities are aimed at specific phases of the Defense acquisition system.

2. During Joint Capabilities Integration and Development System (JCIDS) analyses prior to a Concept Decision, NAVSEA tools must inform Navy and Defense leadership on the entire trade space of ship and fleet architecture options. This requires the capability to generate and analyze hundreds of ship concepts to a rough order of magnitude level within a period of weeks or months. Synthesis tools must be compatible with Design of Experiments, Response Surface, and Set-Based Design methodologies. The analyses must accurately predict relative acquisition and life cycle costs; the impact of emerging technologies and threats; the effect of a ship concept's capabilities on the overall fleet architecture and the fleet capabilities; and the uncertainty of cost and performance predictions.

3. During the Concept Refinement Phase leading to Milestone A, NAVSEA needs tools to execute analyses of alternatives that accurately portray cost versus capability trade-offs, including uncertainty analysis, for dozens of ship concept options within a six-month period of performance. Technology risks must be defined in this phase to a level that facilitates mitigation planning, and all costs must be forecast with sufficient accuracy to develop a program budget and schedule with a known level of execution risk.

4. During the Technology Development Phase, NAVSEA needs tools for Preliminary and Contract Design efforts that allow for informed decisions on subsystem trade-offs, and for detailed

# Summary

- NAVSEA Priorities
  - *Sustain Today's Fleet Efficiently and Effectively*
  - *Build an Affordable Future Fleet*
  - *Enable our People*
- SEA 05 Must be capable of Leading Design from Concept Studies through Contract Design
- Achieving the Goals of the SEA 00 Memo of 4 Feb 2008 is crucial to achieving an Affordable Future Fleet



**THIS SERIES OF WORKSHOPS IS  
AN IMPORTANT PART OF DEFINING  
OUR DESIGN PROCESSES AND  
TOOL DEVELOPMENT PRIORITIES**